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WESTERN BEES OF THE GENUS *CERATINA*, SUBGENUS *ZAODONTOMERUS*

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The species of this group are similar, and extensive use must be made of minor characters of punctation and color to separate the species. Yet these characters, along with nearly all the others, are variable within certain limits. The shape of the apex of the seventh sternite of the males, supposedly very constant, is in reality somewhat variable, particularly in *C. nanula* and *neomexicana*. The variability of the sculpture found on the enclosure of the propodeum is remarkable (see figures). The same variations seem to be found in all the species. Yet in other genera, *Halictus* for example, these characters are apparently of specific value. (See, however, *Augochlora azteca transversalis* Sandhouse and Cockerell.) The male genitalia are useful in distinguishing most of the species, but *C. acantha* Provancher, its subspecies *submaritima* (Cockerell), *nanula* Cockerell and its new subspecies *rigdenae* all have similar genitalia shown for *nanula*.

The area covered by this paper is northern Mexico and the United States except the eastern part. Within this region, the greatest concentration of forms is in California, where ten species and subspecies are found. Probably some species, for example *C. acantha submaritima* (Cockerell), extend into Canada, but I have not seen specimens from there.

I wish to thank Prof. T. D. A. Cockerell for valuable suggestions, for the use of his collection and literature, and for the opportunity to work over some of the collections of The American Museum of Natural History. Types of the new forms described in this paper will be found in the American Museum.

Ceratina sequoiae, new species

Figure 8

FEMALE.—Length, 6 to 8.5 mm. (all but one over 7 mm.); strongly greenish, without blue. Tubercles, a short vertical mark on clypeus, and dots at bases of fore and hind tibiae pale yellow. Center of clypeus impunctate, the edges with a few coarse ill-formed punctures; labrum with numerous small punctures; front impunctate except for a few punctures close to the ocelli and eyes; vertex with rather

sparse, not very coarse punctures, becoming gradually finer on the cheeks as one proceeds downward, until they are exceedingly fine below, especially in large specimens; impunctate band next to posterior orbital margin widened below in large specimens. Labrum, mandibles, antennae, and lower part of cheeks black, without greenish; under side of flagellum faintly brownish. Eyes divergent below, or parallel in small specimens; clypeus low. Scutum finely and sparsely punctate anteriorly, more coarsely and closely punctate on sides where it approaches the tubercles and on the lateral and posterior margins, and impunctate on disk except anteriorly; scutellum and postscutellum finely punctate, closely so except for the center of the scutellum, where the punctures are sparse, as on anterior part of scutum; propodeum very finely and closely punctate on sides and posterior face; pleura very closely and coarsely punctate, the punctures as close as they can be except posteriorly. Tegulae dark brown; disk of scutum, and legs except for parts of the femora, with very little greenish color, the former a little purplish; wings rather dark reddish brown, the stigma and veins black. Abdomen moderately coarsely and closely punctate except for the nearly impunctate first tergite (which has some fine punctures near apex); disks of some of the median tergites a little more finely punctate than sides; profile of sixth tergite convex with a rather large concavity in the distal half; venter of abdomen a little more coarsely punctate than dorsum, with brownish-black margins on some of the sternites; segment one, in most lights, and a semilunar basal median area on sternites two and three black.

California.—Hospital Rock, Sequoia National Park, September 4, 1933. Eight specimens on *Stachys ajugoides* and one on dove weed (Michener).

This runs to *neomexicana* (Cockerell) in H. S. Smith's key, but that is nearly always bluer; almost always with paler wings; punctures of pleura smaller and better separated posteriorly, even in the coarsely punctate forms. *C. sequoiae* differs from *melanoptera* Cockerell, another dark-winged form, by the densely punctured pleura, etc.

Ceratina metallica H. S. Smith

Texas.—Brownsville, June (Wickham), and one without definite locality (Wheeler).

Two of the three females which I have seen have only spots of yellow at bases of fore tibiae, not lines as stated by Sandhouse (1935).

See notes under *C. strenua* F. Smith.

Ceratina nanula Cockerell

Figures 9, 11, 17

Mexico.—Juarez, Chihuahua, May 12 (Cockerell).

New Mexico.—La Cueva, Organ Mountains, 5300 feet elevation (Townsend); Dripping Springs, Organ Mountains, on thistle, August 19 (Townsend and Cockerell); Mesilla, August 13 (Cockerell); Mescalero, July 22, 1898 (C. M. Barber).

Colorado.—Colorado City, May 10, 1904 (T. D. A. and W. P. Cockerell); Starkville, June 13, 1919, 6800 feet elevation, 37° 6′ N., 104° 30′ W. (F. E. Lutz); Boulder, on *Aragalus lambertii*, *Viola nuttallii*, yellow *Ribes*, *Astragalus goniatus*, and *Besseya plantaginea* on dates ranging from April 28 to June 21 (Lutz, Rohwer, and M. D. and M. M. Ellis); Mesa Verde, July 3–7, 1919, 7300 feet elevation, 37° 12′ N., 108° 29′ W., at flowers of *Calochortus gunnisonii* (F. E. Lutz); Tennessee Pass, July 30–August 2, 1919, 10,300 feet elevation, 30° 22′ N., 106° 19′ W. (H. F. Schwarz).

Wyoming.—Cheyenne, June 11, 1920, 6000 feet elevation, 40° 8′ N., 104° 49′ W. (F. E. Lutz).

Idaho.—Paris, July 8, 1920, 6000 feet elevation, 42° 14′ N., 111° 25′ W. (F. E. Lutz).

Males have the apical plate of the abdomen not just as figures by H. S. Smith, but showing an approach toward his figure of *metallica* H. S. Smith. However, it is slightly variable. Specimens from southern New Mexico average slightly bluer than most of the Colorado specimens. Also, they often have paler wings. It may be that we have two slightly differentiated subspecies.

Ceratina nanula rigdenae, new subspecies

Figures 1, 2, 3

FEMALE (type).—Length, 4.5 to nearly 7 mm.; greenish. Tubercles, a short vertical mark on clypeus (sometimes much reduced), and dots on knees pale yellow. Head punctured and marked almost as in *sequoiae* Michener but punctures on vertex more numerous and coarser. Eyes convergent below. Scutum impunctate on disk posteriorly, but anterior half of scutum and a band all the way around the edge rather closely punctate, most sparsely on anterior half; scutum and scutellum moderately punctate, the scutellum more sparsely so medianly; sides and posterior face of propodeum very finely punctate; pleura rather coarsely punctured, but not so coarsely as in *sequoiae*, some shining surface showing between the punctures. Impunctate part of scutum black with a purplish tinge. Legs black; the femora greenish. Tegulae dark brown; wings nearly clear, but darker than typical New Mexico *nanula* Cockerell, the veins and stigma black or very dark brown. Abdomen sculptured and marked as in *sequoiae*, but perhaps a little more coarsely punctate dorsally; a large part of profile of sixth tergite concave.

MALE.—Length, 3.5 to 5.5 mm.; similar to the female but perhaps a little bluer. Clypeus with the usual pale mark, the arms about equal in length; labrum usually with a pale spot; cheeks more coarsely and closely punctate. Apex of abdomen somewhat variable, about as in H. S. Smith's figure of *metallica*, somewhat intermediate between that and *nanula*, but perhaps nearer to *metallica;* hind femora produced to an obtuse angle.

California.—Big Bear (San Bernardino Mountains) (type locality),

in hollow stem (I. Wilson); Mountain Home Creek (San Bernardino Mountains), June 17 (Cockerell); Kenworthy, San Jacinto Mountains, June 8 (F. Grinnell, Jr.); Sandhills, Pacific Grove, July 3 (Cockerell and Moore); Eagle Rock Hills, Los Angeles County, April 14, 1933, and from nest December 20, 1933 (Michener); mouth of San Antonio Canyon, Los Angeles County, April 2, 1933 (Michener); San Gabriel Canyon, Los Angeles County, June 22, 1932, and May 26, 1933 (Michener); Pine Valley (San Diego County), June 16, 1934 (M. and H. James); La Jolla (San Diego County), June 25, 1934 (M. and H. James); one labeled only Southern California. Recorded from flowers of *Rhamnus crocea* and *Salvia mellifera*.

Arizona.—Chiricahua Mountains, June 27, 1934 (Fowler).

Colorado.—Glenwood Springs, July 22–29, 1919, 5800 feet elevation, 39° 33′ N., 107° 20′ W. (H. F. Schwarz).

Both sexes differ from *C. nanula* Cockerell chiefly by the green coloration. I have never seen a Rocky Mountain *nanula* female with the clypeal mark greatly reduced; *rigdenae*, however, frequently has the clypeal mark reduced. The males also show some differences in face markings (see key). The Arizona specimens are a little more coarsely punctate than the others, but the difference is completely bridged by Californian specimens. Possibly at some time an Arizona race may be separated, but this is not advisable without much more material. Named for my mother, who first interested me in natural science.

Ceratina neomexicana Cockerell

Figure 15

Colorado.—Many from Boulder and White Rocks, Gregory Canyon, Boulder Canyon, and Jim Creak, near Boulder, recorded from flowers of *Potentilla*, *Hydrophyllum fendleri*, *Astragalus goniatus*, *Viola nuttalli*, *Nothrocalis cuspidata*, and *Pentstemon*, from May 22 to July 3 (Lutz, W. P. Cockerell, and M. D. and M. M. Ellis); Elbert, June 9–11, 1922, elevation 7400 feet, at *Mertensia* (F. E. Lutz); Hubbard Ranch, near Elbert, June 9 (Figgins); Mesa Verde, July 3–7, 1919, elevation 7900 feet, about 37° 19′ N., 108° 25′ W. (F. E. Lutz); Florissant, June 14, 1908, on sand (Rohwer); Colorado Springs, April 20, on Willow (*Salix*); Colorado City, May 10, 1904, on *Erigeron canus* (T. D. A. and W. P. Cockerell); Starkville, June 13, 1919, 6800 feet elevation, 37° 6′ N., 104° 30′ W. (F. E. Lutz); Ridgeway, July 10, 1919, 7000 feet elevation, 38° 9′ N., 107° 45′ W. (F. E. Lutz); Minnehaha, June 17, 1922, on *Pentstemon gracilis*.

Utah.—Ogden, July 29–30, 1916.

Idaho.—Montpelier, July 6, 1920, 6100 feet elevation, 42° 19′ N., 111° 18′ W. (F. E. Lutz); Paris, July 8, 1920, 6000 feet elevation, 42° 14′ N., 111° 25′ W. (F. E. Lutz).

California.—Arroyo Seco Canyon, Pasadena, Los Angeles County, June 17, 1909 (F. Grinnell, Jr.).

This California specimen represents a great extension of range, but I can find no characters upon which to separate it from the Rocky Mountain specimens. The pleura are a little more coarsely punctate than in most specimens, but intergrades are found in Colorado material. This is the specimen recorded as *nanula* by Cockerell in 1910. It certainly seems to be large enough for *neomexicana*, but perhaps it is an unusually large *C. nanula rigdenae*. It is rather coarsely punctate for that, however.

The profile of the sixth tergite of the female is largely concave. The male has the process of the seventh sternite a little shorter and broader than in H. S. Smith's figure of *C. nanula*, but of the same type. For this reason it does not run well in Smith's key.

Ceratina punctigena (Cockerell)

Figures 4, 5, 6, 10, 14

C. neomexicana punctigena Cockerell, 1916.

Male.—Similar to female. Apex of abdomen much as in H. S. Smith's figure of *C. nanula* or *metallica*. Clypeus with the usual trifoliate pale mark, the arms of about equal length, the lateral ones rather narrow and parallel sided; labrum with a pale area. Cheeks more strongly punctured than in female, not angulate. Hind femora with an inconspicuous obtuse angle (considerably greater than 125°) on under side.

Female.—Sixth tergite convex in profile, with a small deep concavity in the last third. Cheeks variably toothed or angled below. One from same nest as specimens such as that shown in Fig. 4 has unarmed cheeks, but the punctation shows it to be *punctigena*, not *subpunctigena*, new species. This is the only specimen that I have seen which does not have distinctly angled cheeks. Individuals with large cheek teeth, such as that shown in Fig. 5, are usually large specimens, with rather finely punctate cheeks (though not as finely punctate as in *subpunctigena*).

California.—Altadena, Eagle Rock Hills, mouth of San Antonio Canyon, La Crescenta, Pasadena, and San Gabriel Canyon, all in Los Angeles County, from March 3 to June 26, on yellow *Cruciferae*, *Salvia mellifera*, *Paeonia brownii*, *Helianthus*, and almond (Michener); two of each sex removed from nest in twig on December 20, 1933, in the Eagle Rock Hills (Michener); Riverside, March 16, 1925, on *Scrophularia californica* (Timberlake, Coll.); Pine Valley (San Diego

County), June 16, 1934 (M. and H. James); Tejon, July 23, 1934 (M. and H. James).

Ceratina subpunctigena, new species

FEMALE (type).—Length, 9–11 mm.; bluish; clypeus entirely dark or with a much reduced pale line. Clypeus impunctate in the middle, with a few coarse punctures around the edges; rest of head rather coarsely punctate except for the front, which is largely impunctate; cheeks not toothed, very finely punctate below, where the impunctate band near the eye margin is usually widened. Eyes slightly divergent below. Scutum finely punctate in front, more coarsely so at the sides and behind, the disk posteriorly impunctate; scutellum rather finely punctate, quite sparsely so in the middle; postscutellum finely and closely punctured; posterior face and sides of propodeum punctate like the postscutellum; pleura coarsely punctate, not as coarsely so as in *C. sequoiae*, with a small impunctate spot near upper posterior corner, but anteriorly with punctures nearly as close as they can be. Tubercles pale; bases of anterior and posterior tibiae with small pale spots. First tergite impunctate except posteriorly; remaining segments rather finely and sparsely punctate except for the apical ones, which are more closely and coarsely punctate; profile of sixth tergite convex, with a rather small concavity near apex. Wings rather dark grayish, but not as dark as in *sequoiae*, the veins and stigma black; tegulae and under side of flagellum dark brown.

MALE.—Length, 8–9 mm.; similar to female except for the usual sexual characters. Process of seventh tergite slightly shorter than in Smith's figure of *nanula*. Angle on under side of hind femur more conspicuous than in *punctigena*, the apex dull when viewed from toward either end of femur. Median projection of clypeal mark shorter than laterals.

California.—Two from Crystal Lake, San Gabriel Mountains (Los Angeles County) (type locality), on *Verbena prostrata*, July 7, 1934 (Michener); Idyllwild (San Jacinto Mountains), June 24, on *Cirsium* (Cockerell); Dutch Flat (San Jacinto Mountains), on *Stachys*, August 31, 1934 (Michener); Pine Flat (San Diego County), June 16, 1934 (M. and H. James), one labeled only southern California.

This is apparently a Transition zone species, while *C. punctigena* is typically a species of Upper Sonoran.

The female is similar to *punctigena* but has less yellow on the clypeus, differently sculptured cheeks, no cheek angles, slightly larger concavity on sixth tergite, and average size larger. I give a rather full description because none has been published for *C. punctigena*. The male is similar to *C. neomexicana* Cockerell but larger, bluer, under side of flagellum dark brown (pale brown in *neomexicana*). Differs from *C. punctigena* by slightly broader process of seventh tergite, larger and sharper tooth on under side of hind femur, slightly wider lateral extensions and shorter upper extension of clypeal mark, and larger size.

Ceratina utahensis, new species

Figure 7

FEMALE.—Length, about 7.5 mm.; similar to *C. subpunctigena*, having only a minute inconspicuous pale spot on clypeus. Cheeks finely punctate below, but impunctate band next to eye margin narrow. Pleura shining, not as coarsely punctate as in *subpunctigena*, the punctures of anterior part below tubercle being separated by about half their diameters (in *punctigena* and *subpunctigena* they are hardly separated). Eyes slightly converging below. Sixth tergite strongly convex above, with a moderate sized concavity apically. Wings dark reddish brown as in *sequoiae*, nearly as dark as in *melanoptera;* head and thorax a little greener than in *subpunctigena.* Also similar to *C. neomexicana* but abdomen bluer, wings darker, face slightly longer, profile of sixth tergite different (see figures).

Utah.—One from Ogden, July 25, 1920, 4300 feet elevation, 41° 15′ N., 110° 59′ W. (Mrs. F. E. Lutz).

Ceratina gigantea H. S. Smith

Figure 16

MALE.—Length, 6–8 mm.; similar to the female. Clypeal mark with lobes of about equal length, the lateral ones wide at base, tapering to apex; labrum with a yellow area. Cheeks strongly punctate. Clypeus not low as in the female. Eyes strongly convergent below. Process of seventh tergite as in Smith's figure of *C. nanula* but a little shorter. Angle on under side of hind femur obtuse, conspicuous, and sharper than in *punctigena*, its apex not rounded.

FEMALE.—Apical two-thirds or three-fourths of sixth tergite concave, seen in profile.

California.—A pair, apparently in copulation, from Pasadena (Michener); Altadena, mouth of San Antonio Canyon, both in Los Angeles County (Michener). Dates range from March 3 to April 29. Flower records are *Helianthus*, almond, *Salix*, and *Ceanothus crassifolius.*

Ceratina tejonensis Cresson

Figure 12

California.—Pasadena (Michener); Altadena, March 3, 1934, on *Paeonia brownii* (Michener, Coll.); Pasadena, May 31, 1919 (F. Grinnell, Jr.); San Gabriel Mountains, 3000 feet elevation, June 16, 1909 (F. Grinnell, Jr.); Claremont (Baker).

The male agrees with Cockerell's note (1925). One female is 10 mm. long, but agrees otherwise with Cockerell's notes (1910). Sixth tergite of female concave in profile except at base; punctures of pleura not so large that they meet.

Ceratina acantha Provancher

Figure 13

Washington.—†Olympia and †Seattle.

Utah.—Ogden, August 29–30, 1916.

California.—†Niles Canyon, Alameda County, May 23, 1917 (W. M. Giffard); †San Mateo County, May 4, 1917 (F. Muir, W. M. Giffard); Santa Clara County, July 10 (W. M. Giffard); Guernville, Sonoma County, May 31, 1910 (Van Dyke); *Pasadena; *Altadena; *Crystal Lake, San Gabriel Mountains; *Eagle Rock Hills; Puddingstone Canyon, San Jose Hills; *San Gabriel Canyon; *mouth of San Antonio Canyon, Los Angeles County; *Mill Creek, San Bernardino Mountains; *Encinitas (San Diego County), June 28 (Cockerell). (Specimens from California localities for which no collector is given were collected by the author. The dates of these range from March 3 to December 4 but records are few after September. Specimens may be found in nests throughout the winter.)

In the above list localities marked with a * are for typical *acantha*, those marked by a † are for *acantha submaritima*, while unmarked ones are doubtful.

This species can apparently be divided into two subspecies, differentiated by an average of characters of many individuals. The northern subspecies has been named *submaritima* Cockerell (*C. submaritima* Cockerell, 1897). It extends south well into California. Unfortunately, the single Utah female is not sufficient to establish its subspecific identity. It is worth while to record, however, that it has no pale mark on the clypeus. Among the specimens that I have seen, the most melanic (that is, the most extreme *submaritima*) are from coastal central California. Nine females from San Mateo and Alameda Counties all lack yellow on the clypeus, while ten males all have the upper lobe of the clypeal mark reduced or entirely wanting. All these specimens, including those from Washington State, are structurally alike, having, in the male, the process of the seventh tergite not quite so slender as in H. S. Smith's figure. The distinguishing characters of the two subspecies will be found in the key.

In Pasadena I have reared females both with and without a pale clypeal mark from the same nest. From the Pasadena region I have about seventy females but only two males (one from a nest with females)! This may be a local condition, as from Mill Creek two of my four specimens are males, I have a male from Olympia, and the specimens

recorded above as collected by Giffard, and Muir and Giffard are more than half males.

The male is distinguished from all other species found in this country by the acute angle of the hind femur. Profile of last tergite of the female largely concave.

Key to Species

For convenience most of the known species of the subgenus *Zaodontomerus* found in the United States and northern Mexico have been included in the key. Notes on species not in the key are appended. The only other species of *Ceratina* found within this region are the small black ones (*arizonensis* Cockerell, Fig. 18, its form *vanduzeei* Cockerell, and *cockerelli* H. S. Smith (*lunata* H. S. Smith)) and a large species, apparently of a different group (*wagneri* Friese). Species marked by a * are known to me only from the descriptions.

Males

1.—Apex of seventh tergite ending in two small teeth.....**diodonta* H. S. Smith.
Apex of seventh tergite not ending in two teeth.....2.
2.—Hind femora expanded rather abruptly near the base, without a triangular projection near middle (Sandhouse, 1935); tubercles pale; projection of seventh tergite twice as wide as long.....**dupla* Say.
Hind femora with a ventral median tooth.....3.
3.—Projection of seventh tergite three times as wide as long; tubercles pale; bluish eastern species.....*calcarata* Robertson.
Projection of apex of abdomen much narrower.....4.
4.—Fore tibiae with a longitudinal pale line; tubercles pale.....5.
Fore tibiae with only a pale dot at base.....6.
5.—Wings fairly clear, pleura finely punctate.....*metallica* H. S. Smith.
Wings very dark; pleura very coarsely but not very closely punctate. *melanoptera* Cockerell.
6.—Tubercles dark.....7.
Tubercles pale.....10.
7.—Rather small blue-green species with rather finely punctured pleura; angle of hind femur acute.....8.
Rather small green species, probably similar to *acantha;* angle of hind femur acute.....**acantha ehrhorni* (Cockerell).
Larger blue species with conspicuous coarse punctures on pleura.....9.
8.—Arms of clypeal mark equal or nearly so.....*acantha* Provancher.
Upper arm of clypeal mark shorter than the others, frequently wanting. *acantha submaritima* (Cockerell).
9.—Angle on under side of hind femur obtuse.....*gigantea* H. S. Smith.
Angle on under side of hind femur about a right angle.....*tejonensis* Cresson.
10.—Angle on under side of hind femur obtuse, considerably over 125°; large blue or blue-green species.....*punctigena* (Cockerell).

Angle on under side of hind femur sharper, though obtuse, a little less than 125°.....11.

11.—Over 6 mm.; projection of seventh tergite usually wider than long.....12.

Under 5 mm.; projection of seventh tergite usually as wide as long.....13.

12.—Smaller, greener; under side of flagellum light brown; apex of sixth tergite with an unusually dense brush of hair, giving the apex of abdomen, seen from above, a pointed appearance; projection of under side of hind femur not as in the next.....*neomexicana* Cockerell.

Larger, bluer; under side of flagellum dark brown; projection of under side of hind femur rounded at apex when viewed from toward either end of femur.

subpunctigena Michener.

13.—Blue; upper arm of clypeal mark distinctly longer than laterals.

nanula Cockerell.

Blue-green; upper arm of clypeal mark equal to or hardly longer than laterals.

nanula rigdenae Michener.

FEMALES

1.—Tubercles dark; bluish or bluish-green species.....2.

Tubercles pale.....5.

2.—Smaller, less than 7 mm.; bluish green; pleura finely and rather sparsely punctate; eyes converging below.....3.

Larger, 10 mm. or more; eyes diverging below; blue; pleura coarsely punctured, but shining ground showing between the punctures except sometimes anteriorly; clypeus low.....4.

3.—Clypeus without a pale mark, or the mark much reduced.

acantha submaritima (Cockerell).

Clypeus frequently with a pale mark.....*acantha* Provancher.

4.—Upper part of cheeks very finely and sparsely punctate, the punctures behind top of eyes separated by much more than their diameters.

gigantea H. S. Smith.

Upper part of cheeks more coarsely and closely punctate, the punctures behind top of eyes separated by about their diameters or less....*tejonensis* Cresson.

5.—Pleura coarsely punctate, the punctures, anteriorly at least, as close as they can be, or at least many of them meeting; size rather large.....6.

Pleura more finely punctate, showing shining ground between the punctures..9.

6.—Blue to bluish-green species.....7.

Green species (the greenest of any recorded in this paper); inner orbits divergent in large specimens, parallel in small ones (see also *neomexicana*, which is sometimes green).....*sequoiae* Michener.

7.—Apical tergite largely concave in profile; inner orbits usually parallel.

neomexicana Cockerell.

Sixth tergite convex except for a small deep concavity near apex.....8.

8.—Clypeus dark or with a reduced yellow mark; cheeks finely and sparsely punctate below, the impunctate band next to eye margin usually widened below; cheeks not toothed.....*subpunctigena* Michener.

Clypeus with a yellow bar; cheeks more coarsely and closely punctate below, the impunctate band next to the eye margin narrow except in a few large individuals; cheeks almost always toothed or angled below.

punctigena (Cockerell).

9.—Legs brown; small bluish eastern species.....*metallica* H. S. Smith.
Legs black or metallic, except for the tarsi which may be brown.....10.
10.—Impunctate, usually blackish, area of scutum restricted, not extending beyond the parapsidal grooves, and partly divided medianly by a longitudinal green punctured area; eastern.....*dupla* Say and *calcarata* Robertson.
Impunctate blackish area of scutum larger, extending beyond the parapsidal grooves, though they may be margined by a row of punctures on each side, and not so much divided medianly; western.....11.
11.—Abdomen blue; eyes converging below.....12.
Abdomen, and rest of body, blue-green or green.....13.
12.—Length, 7.5 mm.; head and thorax blue-green; wings dark.
utahensis Michener.
Length, 6 mm. or less; head and thorax blue; wings pale....*nanula* Cockerell.
13.—Length, 7 mm. or more.....*neomexicana* Cockerell.
Length, less than 7 mm., usually considerably less, but average size a little larger than *nanula*.....*nanula rigdenae* Michener.

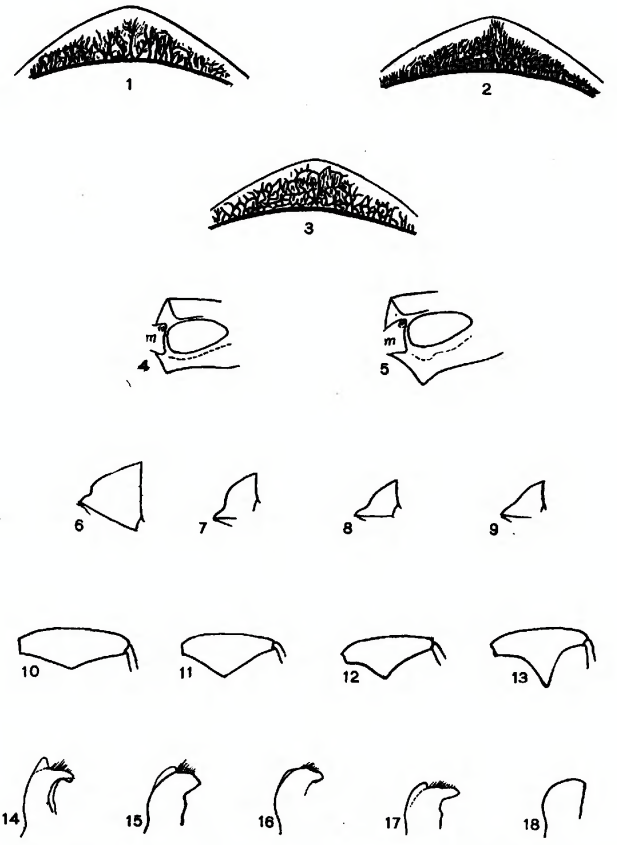
**C. strenua* F. Smith from Texas has, in the male, reddish anterior tibiae with a light stripe on outer side. It should differ from *metallica* H. S. Smith by the rounded apex of the abdomen. However, I suspect that *metallica* is a synonym of *strenua*. Possibly I have never seen female *metallica*, but one from Maryland ought to be that form. I cannot distinguish it from Texas examples which seem to be *strenua*.

**C. pacifica* H. S. Smith (female) has a large impunctate area on the upper part of the pleura; cheeks evidently toothed after the manner of *punctigena*.

**C. melanoptera* Cockerell (female) has very dark wings. It is bluer than *sequoiae* and more coarsely punctate than *utahensis*.

**C. diodonta* H. S. Smith (female) is similar to *nanula*, but more brassy green, punctures of face broader, etc.

C. dupla Say and *C. calcarata* Robertson. I am unable to distinguish these species in the female. I have not been able to separate them by Sandhouse's key (1935), as single individuals were found to have a combination of the characters of the two species, as tabulated by Sandhouse. While on the subject of these species, I may say that certain western records of *dupla* are apparently erroneous. At least one Colorado specimen recorded as *dupla* is really *neomexicana*. I strongly suspect that all western records of both of these species are incorrect.



Figs. 1, 2, and 3. Enclosure of propodeum of *Ceratina nanula rigdenae* Michener, female.

Fig. 4. Side of head of *Ceratina punctigena* (Cockerell), type female. *m* is the mandible. Dotted line indicates edge of impunctate band near eye margin.

Fig. 5. Side of head of *Ceratina punctigena* (Cockerell), female. Explanation as for Figure 4.

Fig. 6. Lateral view of apex of abdomen of *Ceratina punctigena* (Cockerell), female.

Fig. 7. Lateral view of apex of abdomen of *Ceratina utahensis* Michener, female.

Fig. 8. Lateral view of apex of abdomen of *Ceratina sequoiae* Michener, female.

Fig. 9. Lateral view of apex of abdomen of *Ceratina nanula* Cockerell, female.

Fig. 10. Hind femur of *Ceratina punctigena* (Cockerell), male.

Fig. 11. Hind femur of *Ceratina nanula* Cockerell, male.

Fig. 12. Hind femur of *Ceratina tejonensis* Cresson, male.

Fig. 13. Hind femur of *Ceratina acantha* Provancher, male.

Fig. 14. Apical part of stipes of *Ceratina punctigena* (Cockerell).

Fig. 15. Apical part of stipes of *Ceratina neomexicana* Cockerell.

Fig. 16. Apical part of stipes of *Ceratina gigantea* H. S. Smith.

Fig. 17. Apical part of stipes of *Ceratina nanula* Cockerell.

Fig. 18. Apical part of stipes of *Ceratina arizonensis* Cockerell.

APPENDIX

While on the subject of *Ceratina*, I wish to record some localities for *C. arizonensis* Cockerell (Fig. 18), the only Californian species not belonging to *Zaodontomerus*.

California.—Altadena, Eagle Rock, Pasadena, San Gabriel Canyon, mouth of San Antonio Canyon, and La Crescenta, all in Los Angeles County; Murrieta; Corona. Dates range from March 3 to December 4. From August to March they are uncommon, though I have records for September, October, November, and December. Specimens were taken from *Rhamnus crocea*, *Heliotropium curassavicum*, *Stephanomeria*, *Eriogonum fasciculatum*, *E. gracile*, *Phacelia tanacetifolia*, *Ceanothus crassifolius*, *Baccharis*, *Salix*, *Lotus*, and *Stellaria media* (all Michener, Coll.).

This is one of the most common bees in southern California, but it has not adapted itself to cultivated plants as has *Ceratina acantha* Provancher, the latter being, except for *Halictus meliloti* Cockerell, the most common bee on cultivated flowers in Pasadena. *C. arizonensis* nests in twigs, as do other species of the genus. I have included a figure of a stipes of this species, to show how different it is from the *Zaodontomerus* group.